https://doi.org/10.29321/MAJ.10.A04696

Some Factors Governing Fruit-bud Formation in Mangoes (*Mangifera Indica* Linn.)

By K. C. NAIK, M. Sc. (Bristol),
Fruit Specialist, Kodur,
and
M. MOHAN RAO, M. Sc.

Introduction.

That the production of profitable crops of marketable size and quality is the end-result of a long series of factors is a well established fact. Broadly, these factors can be classified under two groups—one, which is partially or completely under the control of the grower and another, which is not. The latter group comprises of mainly a complex series, which can be conveniently summarised under the heading of climate or season, and which may directly or indirectly exert a determining influence upon crop size. Even though this group of factors is beyond the control of man, it is possible to establish significant correlation between each of the factors constituting this group and the tree-performance, and thus obtain a precise knowledge of the optimum cultural practices in relation to the various types of tree-requirements as modified by this group of factors.

In the chain constituting the other group of factors, there are undoubtedly numerous links to be considered. This group of factors demands special care of the grower, as by a proper understanding of the influence of some or all of these factors it is not only possible to ensure better crops in normal years, but it may also enable the grower to reduce or minimise the losses resulting from unfavourable conditions not directly or easily controllable.

Realisation of the above stated fundamental facts has been primarily responsible for a long series of investigations on many fruits in many parts of the world. All these studies are, in effect, designed to supplement horticultural field experiments by studies aimed to furnish a better understanding of the tree processes. One of the simplest and most convenient methods of obtaining a full understanding of the tree-performance and the various cultural practices that are required to be adopted for optimum production, is through the establishment of a set of definite relationships between certain readily distinguishable growth features and tree-productivity. As in all other agricultural sciences, orchard practices must be based on the correct understanding of the plant growth and production; and the aim of all investigational work in horticulture should be mainly to place at the disposal of the grower, information to bring about in the tree the optimum set of growth conditions which are associated with profitable crop size and quality. To achieve this objective a detailed study of the growth processes of the tree is obviously essential.

Between the two groups of factors stated above can perhaps be placed the genetic make up of the tree. Regulation or improvement of the inherent productivity of the tree is a work beyond the scope of short investigations as those under report. However, attempt has been made, on the basis of certain preliminary blossom biological and pollination studies to throw some light on this question also. But the present studies are mainly directed towards an understanding of the growth processes of certain commercial varieties of mangoes at Kodur and the relationship between some of these features and flower-bud formation.

I. Studies on Certain Aspects of Growth.

Introduction. An attempt is made to present data on the peculiar growth features that characterise a few of the South Indian commercial mango varieties. At the same time data are adduced to present the characteristic features of growth in the various parts of the tree and in respect of those parts which have had different kinds of performances in the preceding season. The age of the tree parts has also to be necessarily given due consideration while evaluating their performances. In short, the studies reported upon in this paper are aimed to bring forth the mango tree growth in all its varied forms and patterns, as a step for further elucidation of the main problem of fruit-bud formation.

Material and methods. A grafted mango plantation at Kodur containing trees of about 20 years of age was selected in August 1936 for this study. The study was in progress till January 1940.

Growth features of all shoots For the study of certain easily distinguishable growth features, four of the important commercial varieties of mango in this tract, viz., *Neelum*, *Bangalora*, *Baneshan* and *Mulgoa* were chosen. For one of the investigations, only four bearing trees in each of *Neelum*, *Bangalora* and *Baneshan* varieties, which appeared uniform looking in tree vigour and health were selected. About 20 to 25 healthy looking shoots situated on all sides of the tree were selected at random in August 1936 and tagged. Every month, from August 1936 to March 1939, the number of new shoots produced on these selected shoots were tagged and their extension growth recorded.

Growth features of different classes of shoots. Observations were carried out on the shoots, irrespective of their nature, origin and previous performance. In order to throw light on the growth features of the various classes of shoots commonly met with in mango trees, it was decided early in 1939 to record the growth measurements of each class of shoots separately. With this end in view the following six classes of shoots were chosen from three trees in each of the three varieties, *Neelum*, *Bangalora* and *Baneshan*, in March 1939, when new growth was just commencing for that year. The number of shoots tagged was 60 to 75 in each class or 360 to 450 in all classes per variety, with a minimum of 20 in each class per tree.

1 and 2—Leaders and laterals of 1938 that failed to flower in 1939 (referred to subsequently as "non-flowered leaders" and "non-flowered laterals" respectively).

3 and 4—Leaders and laterals of 1938 that flowered in 1939 (referred to subsequently as "flowered leaders" and "flowered laterals" respectively).

5 and 6—Leaders and laterals of the first flush of 1939 (referred to subsequently as " current year's leaders" and "current year's laterals" respectively).

Besides these, 30 shoots of each of the six classes mentioned above from a *Mulgoa* tree and 41 leader shoots of *Neelum* from two of the trees included under the above mentioned investigation and which carried fruits to maturity during 1939, were labelled separately in July and October 1939 respectively for observation.

As shoots giving rise to inflorescence from the apical buds are incapable of producing extension growth from the same region, it will be clear that, the leaders of the first flush of 1939 are those that were produced by the leaders or laterals of 1938 which failed to flower in 1939. In order to make the current year's growth selected for observation representative of all classes of shoots on which they originate, care was taken to select the leader shoots of the first flush of 1939 in fairly equal numbers from each of the non-flowering batch of leaders and laterals of the previous year and also to select the laterals in equal numbers from each of the four classes of shoots of the previous year.

The second investigation was commenced in March 1939. During each of the subsequent months up to January 1940, length measurements of the new growths made on all classes of shoots were taken individually at a definite interval of a month, and the extension growth produced in each month on each class of shoots was thus obtained. At the same time new leaders and laterals produced were tagged and measured.

Season and duration of growth. Observations made from August 1936 to January 1940 on *Neelum, Bangalora* and *Baneshan* have shown that, as a general rule, growth in these three varieties during a calendar year is characterised by two distinct active phases ; one occurring from February to June, and another from October to November. Minor growth flushes have also been seen to occur in some varieties, as for example in *Baneshan*, in December 1939. The relative amount of extension growth made during a given period, and consequently, the time of growth cessation have, however, been found to vary to some extent between the varieties during the period under review.

Differential behaviour of varieties to seasonal conditions. The mean extension growth made by the three varieties from 1937-38 to 1939-40 is given in Table I. It is clear that the varieties do not differ significantly from each other, while the seasons do. The data further show that there is no definite cyclic growth from year to year, since in all the

varieties the latter two years have shown significantly less extension growth than the former year; and between the latter two years there is no significant difference in any of the three varieties.

Number of new shoots formed. The production of blossoms may be governed not only by the amount of extension growth made but also by the number of new shoots produced. In Table II are presented the total number of new shoots produced by the three varieties during 1937-38 and 1938-39. It is seen that *Neelum* has produced a significantly higher number of new shoots than either *Bangalora* or *Baneshan*, and that the number of shoots is definitely larger in the latter year than in the former in all the varieties.

Growth features of different classes of shoots. The above inferences relating to the growth features of the varieties have been drawn from a consideration of all classes of shoots. Observations made on the growth produced by the different classes of shoots have shown that they are possessed of varying features. In particular, the features in respect of which the different classes of shoots in the same variety differ markedly from each other are enumerated below :—

1. Number of flushes produced in the year.
2. Month in which the peak of extension growth of the first flush occurs during the year.
3. Month of cessation of growth of the first flush in the year.
4. Number of lateral shoots produced in the year.

The total number of shoots produced per 100 selected shoots of each of the six different classes in four different varieties has been statistically analysed and presented in Table III. The following additional inferences may be arrived at from these data.

(a) The number of lateral shoots produced per hundred selected shoots varies very significantly between different classes of shoots in the same variety, but not significantly between varieties.

(b) The flowered shoots have produced a significantly higher number of lateral shoots than the non-flowered ones or current year's shoots. The leaders have produced also a significantly higher number of laterals than the lateral shoots.

(c) The current year's shoots and non-flowered laterals appear to be relatively unimportant in lateral shoot production.

Growth features of shoots that carried fruits to maturity and of those that shed the flowers. The data collected during 1939 on 41 leader shoots of *Neelum* that carried fruits to maturity in 1939 and on 75 leader shoots of the same variety which had flowered but had subsequently shed the panicles completely before fruit setting, are presented in Table IV.

It is observed from these that the shoots carrying fruits to maturity have shown lower extension growth during 1939 and new laterals on a smaller

proportion of shoots during that year than those in which the flowers had shed early. The longest lateral shoot on the former class of shoots was only 5·8 cm., while that on the latter class was 19·6 cm.

The above facts throw some light on an interesting aspect of the problem of "off" and "on" year bearing in mangoes It will be shown in a separate paper that the optimum factors for productivity in mangoes are, among others, a good crop of lateral shoots and a medium amount of extension growth in the season previous to flowering. The shoots carrying fruits to maturity are, therefore, considered to be comparatively valueless for producing a crop of flowers or of fruits during the succeeding season, because of low extension growth and the failure of a large number of shoots to produce new lateral shoots. The shoots in which flowers shed early, producing as they do, a much larger number of shoots of relatively better extension growth, are consequently possessed of better flower bearing potentialities. It will also be shown later that the current year's growth on the former class of shoots have borne no panicles in the succeeding season, whereas those on the latter class have given rise to some crop.

In effect, the latter class of shoots behaves like artificially de-blossomed shoots; the only difference being that in one case de-blossoming has occurred as a natural phenomenon, while in the other by the agency of man.

Summary and conclusions. Annual growth in *Neelum, Bangalora* and *Baneshan* varities of mango is characterised by two distinct active phases, one occurring from February to June and another in October—November. Minor growth flushes also occur in some varieties mainly in December. The relative amount of extension growth, the peak of the growing season, the duration of the growing period, and consequently the time of growth cessation vary to some extent between varieties from season to season or in the same season.

The varieties under study do not show any cyclic growth tendency from year to year.

Different classes of shoots are possessed of different growth features; therefore, each of these shall have to be treated as independent entities for a study of their performance.

Previous performance and origin of the shoots have a determining influence on the production of laterals.

Shoots that carry fruits to maturity in one year produce a much lower extension growth and new laterals on a smaller number of shoots in the same year than those which failed to flower in the year or in which the flowers had shed early in that year.

As has been indicated already, the data presented above, though by themselves may be informative, are likely to be of little practical value if the relation between these various growth features and blossom-bud formation is not established or indicated. This forms the subject matter of the next paper in the series.

TABLE I. The mean extension growth made by three varieties of mango from 1937–38 to 1939–40.

Serial Number.	Variety.	1937–38	1938–39.	1939–40.	Total.	Mean.
1	*Neelum*	31	5	9	45	15·0
2	*Baneshan*	30	4	10	44	14·7
3	*Bangalora*	29	18	6	53	17·7
	Total	90	27	25	142	General Mean
	Mean	30·0	9·0	8·3		15·8

Difference between varieties (for P = 05)—Not significant.
Do. years do. —Significant.
Standard error of difference between any two means for years=4·4
Critical difference (P=·05)=12·3.
Conclusion. 1937-38 1938-39 1939-40.

TABLE II. The number of growths produced (as percentage of selected shoots) on the three varieties during 1937—38 and 1938—39.

Variety.	1937—38.	1938—39.	Total.	Mean.
Neelum	474	708	1182	591
Bangalora	370	554	924	462
Baneshan	364	540	904	452
Total	1208	1802	3010	
Mean	402·7	600·7	General Mean—501·7	

Difference between varieties (for P=·01)—Significant.
Do. years do. — do.
Standard error of difference between any two means for varieties=17·9
Critical difference (P=·01)=104·5
Conclusion. *Neelum* *Bangalora* *Baneshan*

TABLE III. The number of lateral shoots produced per 100 selected shoots in each of the six different classes in four varieties.

Varieties.	Laterals produced by						Total.	Mean.
	Non-flowered		Flowered		Current Year's			
	Leaders.	Laterals.	Leaders.	Laterals.	Leaders.	Laterals.		
Neelum	71	23	143	130	16	5	388	64·7
Bangalora	29	20	145	36	—	—	230	38·3
Baneshan	55	—	89	56	28	21	249	41·5
Mulgoa	17	13	107	77	—	—	214	35·7
Total	172	56	484	299	44	26	1081	
Mean	43·0	14·0	121·0	74·8	11·0	6·5	General Mean—45·04	

Difference between Varieties (for P=·05)—Not significant.
" " Leaders and Laterals (for P=·05)—Significant.
" " Flowered and non-flowered shoots (for P=·01)—Significant.

TABLE IV

The proportion of growing shoots in and mean extension growth made by leader shoots of *Neelum* that shed flowers early and those that carried fruits to maturity.

Class of Shoot.	Number tagged.	Number producing laterals.	Percentage.	Total mean extension growth for the year (Cm.)
Shoots that shed flowers early	75	54	72	14·54
Shoots that carried fruits to maturity	41	8	20	1·04

Acknowledgments. During the period of about four years when this investigation was in progress, the authors have had the valuable assistance of the late Sri P. Parthasarathy, then Farm Manager, Fruit Research Station, Kodur, for a time. A portion of the data presented in this paper formed a part of the thesis submitted by the junior author to the University of Madras for the M. Sc. degree. The authors wish to record these facts with gratitude.

Groundnut as Human Food.*

By C. M. JOHN,

Oilseeds Specialist, Agricultural Research Institute, Coimbatore.

Food constituents. The food-stuffs that we consume should contain the right amount and kind of proteins, fats, carbohydrates, vitamins and mineral salts, if we are to live in normal health and our body is to function properly. Each of these ingredients supplies some requirement or other of the body complex. Proteins are necessary for building the muscles; carbohydrates are the body's chief source of energy; fat is the heat producer while mineral salts and vitamins play an important part in the physiological functions. Any one food-stuff that is available to man may not contain all the above ingredients, so that by consuming one particular product we cannot supply the full requirements of the body. Therefore, we must combine them judiciously so that our daily diet contains all these essential ingredients in the right proportions.

The South Indian diet. The South Indian diet which usually consists of a large quantity of highly polished rice and only very small quantities of *dhal*, grams, vegetables, milk, etc., is rich only in carbohydrates. It is deficient in other requirements of the body, especially proteins which are so essential for muscle building. To remedy this defect we have to include in our rice diet adequate quantities of other food-stuffs that supply these deficiencies but at the same time are cheap and within easy reach of even the poor.

Food value of groundnuts. Groundnut which is produced in abundance in our Province is widely acknowledged as a rich and cheap source

* Contribution No. 20 of the Oilseeds Section of the Madras Department of Agriculture.